Chair of Communications Engineering
TUM Department of Electrical and Computer Engineering
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Master's Thesis

[quantum] Asymptotic continuity of restricted quantum relative entropies under general channels

Asypmtotic continuity is a property in the form of inequalities (classically known also as inequalities of the reverse-Pinker type) that is necessary to prove upper bounds on operational capacities.

The (quantum) relative entropy (also known as quantum divergence and classically also known as Kullbackt-Leibler divergence), can be used to define various entanglment measures many of which have a proven asymptotic continuity.

Of particular interest are the restricted quantum relative entropies defined by Marco Piani (https://arxiv.org/abs/0904.2705), many of which satisfy asymptotic continuity (A.S.)

- https://arxiv.org/abs/quant-ph/9910002
- https://arxiv.org/abs/quant-ph/0203107
- https://arxiv.org/abs/quant-ph/0507126
- https://arxiv.org/abs/1210.3181
- https://arxiv.org/abs/1507.07775
- https://arxiv.org/abs/1512.09047

In the above there are maybe 2-3 different proof styles.
We can group the results in the above as follows:

- A.S. for entropy, conditional entropies, mutual information, conditional mutual information
- A.S. for relative entropies with infimum over states on the second argument
- A.S. relative entropies with infimum over state *and maximization over measurement channels*

The goal of the project is to generalize the last case to asymptotic continuity for relative entropies with infimum over state and maximization over *general* channels

- Partial results toward this goal can be found in the appendix of my PhD thesis: http://web.math.ku.dk/noter/filer/phd18rf.pdf
- Such a result would have immediate applications to this paper: https://arxiv.org/abs/1801.02861
- Possible new proof directions could involve the use of Renyi ⍰-realtive entropies with the limit ⍰->1

Prerequisites

Knowledge of quantum information is highly recommended/required.
Knowledge of matrix analysis will be a strong advantage.

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